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Air grain cleaner

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Abstract

An air grain cleaner 10 comprising a chamber in the form of an air box 12 within which grain can be separated from a grain mixture and thereby cleaned. The air grain cleaner has an internal grain hopper 14 which is provided with a manually operable valve 18 in an inlet 20 in a wall in an upper part of the air box 12 for introducing the grain mixture into the air box. A second inlet 22 is formed in a side wall 24 of the air box 12 for admitting an air stream into the air chamber. A fan 26 for producing the air stream communicates with the inlet 22 via a conduit 28. An air pressure equaliser 30 for reducing the pressure gradient of the air stream across the inlet 22 is located in the conduit 28 adjacent the inlet 22. A grain deflecting plate 32 is fixed within the air chamber 12 beneath inlet 20. Plate 32 is also inclined toward the air inlet 20. A plurality of air deflecting plates 34 arranged in a stack are inclined toward the grain inlet 20 to deflect the air stream to the grain. When the air stream contacts the falling grain mixture, it pushes the grain and other components of the grain mixture different distances in the downstream direction due to their different weight and/or size so as to separate the individual components of the grain mixture.

Description

AIR GRAIN CLEANER

The present invention relates to an air grain cleaner.

Air grain cleaners are commonly used for separating grain from intermixed unwanted foreign bodies such as, for example, chaff or grass seeds. Throughout this specification the term "grain" @ is used in a general sense to denote grain or other particulate vegetables or fruit derived from agriculture, including for example cereals such as wheat, oats, corn, barley, maize, rape seed or lupins etc; peas and beans. In addition, the term "grain mixture" is used in a general sense to denote a wanted grain, for example wheat, intermixed with unwanted foreign bodies which may include other types of grain, for example barley.

Typically, air grain cleaners overate by blowing a stream of air across the path of a free fal1in stream of grain mixture. Due to their different weight and/or size, each component of the grain mixture is blown different distances in the direction of flow cf the air stream thereby resulting in separation of the components. The separate components form corresponding piles which can later be collected.

In prior art air grain cleaners the eir stream is produced almost exclusively by centrifugal tans of various configurations. One type of centrifugal fan commonly used has an impeller similar to that used in water pumps and generates a relatively @ righ pressure and low volz..e air stream. Another common type of centrifugal fan has an impeller similar to tat of a paddle wheel and provides a very low pressure but high volume air stream. While the centrifugal ans allow adequate grain cleaning, the air flow dynamics of air grain cleaners using sch fans --re not entirely satisfactory.

The major deficiencies in sch air grain cleaners are unevenness of air pressure across the air stream cleaning the grain and less than optimum balance between air pressure and air volume in the air stream These features affect the cleaning efficiency both in terms of tne degree of separation of the individual components of the grain mixture and the rate of cleaning (or capacity) of the air grain cleaner.

It is an object of the present invention to attempt to alleviate at least one of the above deficiencies in the prior art.

According to the present Invention there is provided an air grain cleaner when used for separating grain frm a grain mixture comprising:
a chamber within which said train can be separated from said grain mixture, said chamber including a first i.nlet disposed in an upper part of the cha@ber so that a grain mixture introduced through the first inlet can fall by action of gravity into the chamber and, a second inlet for admitting an air stream into the chamber, said air stream directed toward said grain mixture as it falls into the chamber;
a propeller@like fan in communication with said second inlet for producing said air stream and including 2 plurality of fan blades extending radially from an axis of rotation of said fan;
an air stream equalising means for reducing the pressure gradient ot said air stream across said second inlet, said air stream equalising means comprises a plurali@ of ducts arranged in a matrix-like configuration for delivering said air stream from --.id fan to said second inlet; and, one or more air deflecting plates arranged in a stck located na but spaced from said second inlet. said plates teing disposed in mutually parallel and inclined planes whereby, in use, said air stream blows any grain in said grain mixture a different distance In the downst-eam direction of the air stream from other components of said grain mixture to separate and thereby clean said grain frown said other components of the grain mixture, and any grain which lands on any one of said plates can slide down that plate by action of gravity to fall through the space between that plate and the second inlet into said chamber.

Preferably said air stream equalising means is located between said fan and said second inlet.

Preferably said air stream egualising means comprises a plurality of duals arranged in a matrix.

Preferably each of said ducts are of constant cross-sectional area.

Preferably the cross-sectional area of each duct is sabstantially the same.

Preferably said air grain cleaner further comprises a conduit facilitating said communication

between the ropeller-like fan and said second inlet, said conduit including a dividing plate extending along a longitudinal central plane of at least a portion of the length of the conduit.

Preferably said air grain cleaner further comprises an elongate shroud in which said propeller-like fan is hosed, and having one end located adjacent said conduit, said far.

being disposed near said one end.

Preferably said air grain cleaner further comprises strain deflecting .means fcr deflecting said grain mixture so as .e fall in a direction toward said second inlet.

Preferably said cjrain deflecting means comprises a plate disposed in an inclined plane and located adjacent said fiist inlet so that said grain mixture, after passing through said first inlet, falls onto and slides down said plate.

Preferably said air deflecting plates are arranged for deflecting said air stream to flow in a direction substantially opposite to that in which said mixture falls.

Preferably said inclined plane is subsLantially parallel to the planes containing said ar deflecting plates.

Preferably said air grain cleaner further comprises opposite and substantially symmetrically profiled side wails, said opposite side walls having respective first port lons which are uniformly spaced apart by a first distance and respective second portions which are uniformly spaced apart by a second distance being greater than said first distance, and one or more movable grain dividers for dividing a lower part of said chamber into a plurality of grain collection areas and disposed between said respective second portions, opposite sides of each grain divider extending laterally beyond adjacent first portions of said side walls.

Embodiments of the present invention will now be described by way of example only, with reference to the accompanying drawings in which:
Figure 1 is a side view of the air grain clearer;
Figure 2 is a perspective v.ew of an air pressure ecualising means used in the air grain cleanser shown in Figure 1;
Figure 3 s an enlarged side view of an air deflecting plate arrangement incorporated in the air grain cleaner; and,
Figure 4 is a partial end view of the air grain cleaner showing a grain ditrider.

As shown in Figure 1, an at grain cleaner JO comprises a chamber in the form of an air box 12 within which grain can b separated from a grain itre. The separation of grain from the grain mixture effectively cleans the grain. The grain cleaner 10 includes an internal hopper 14 for feeding a grain mixture into the air box 12. Grain is fed into the hopper 14 via external means (not shown). Grain stored within the internal hopper 14 can be fed into the air box 12 via a manually operable valve 18 disposed in a grain inlet 20 to the air box 12. An air inlet 22 is fcrmed in the lower part of a side wall 24 of air box 12 for admitting an air stream into the air box. Fan 26 for producing the air stream communicates wits the Inlet 22 via a conduit 28. An air pressure equaliser 30 for reducing the pressure gradient of the air stream across the inlet 22 is located in the conduit 28 between the fan 25 and inlet 22. More specifically, the air pressure equaiiser 3C is located in the conduit 28 adjacent the air inlet 22.

An inclined grain deflecting plate 32 is disposed beneath the inlet 20 so as to direct grain which leaves said hopper 14 to fall in the general direction toward the air inlet 22. Also, a plurality of air deflecting plates 34 arranged in a stack are located near but spaced from the

air inlet 22. The air deflecting plates 34 are disposed in mutually parallel and inclined planes. @n this embodiment, the air deflecting plates 34 are substantially parallel with the grain deflecting plate 32. Because the air deflecting plates 34 are spaced from the air inlet 22, any grain 36 which may land on the plates 34 will slide down respective plate and fail through the gap between the plate and the air inlet under a further lower plate 38 and into the air box 12 (refer Figure 3j. This substantially prevents grain from inadvertently passing through the air e"aliser 30 and depositIng at the bottom of the conduit 28.

Air entering the air box is vented through a screen 38. The screen 38 forts a substantial portion of side wall 4G of the air box 12.

A viewing window 42 is also formed in wall 44 of the air box so as to allow viewing of the air grain cleaner in operatior..

A plurality of chutes 45 depend downwardly from a bottom wall 48 of the air box 12. Respective grain dividers SO are located between adjacent ones of the chutes 46. Referring to
Figure 4, it can be seen that each grair. divider 50 includes a manually operable handle 52 for pivoting the grain divider plate 50. Wall 44 of the air box 12 and opposite wall 54 are of symmetrical profile. Walls 44 and 54 include first portions 44" and 54" and adjacent second portions 44" and 54'. The wall portions 44" and 54" are flared outwardly in respect to wall portions 44' and 54'. That is, the distance between wall portions 44" and 54" is greater than that between wail portions 44' and 54'. The grain deflecting plates 5: are disposed between the wall portions 44" and 54" and have their opposite sides 56 and 58 extending laterally beyond wall portions 44' and 54'. As a result of this, grain which may slide along or fall down wall portions 44' and 54' is unlikely to become wedged or otherwise caught between the opposite sides 56, 58 of the grain deflecting plates and the interior of wall porticos 44. and 54".

Referring again to Figure 1, it can b seen that the grain dividers SO divide the bottom wall 48 of the air cnarrber 12 ,nto three separate grain collection areas 62, 64 and 56.

Depending on the weight ow each grain in the grain mixture, the grains will be blown across the air box 12 different distances and fall in one of 'Aie th-ee grain areas 62, 64 and 56 for later dumping through one of the chutes 46.

Referring to Figure 2, it can be seer. that the air pressure equaliser 30 comprises a plurality of ducts 68 arranged in a matrix-like manner. Each duct 68 has a substantially constant cross-sectional area and the cross-sectional area of each duct is substantially the same. In one embodiment, the equaliser 30 may have a depth of 35 cm, a length of 25 cm and be 90 cm across, with the cross-sectional area of each duct being 4 cm square.

An air streak director 70 in the forzn of a plate s installed centrally along the conduit 28 to assist in eliminating swirling air turbulence associated with the fan 26. The rotation of the fan 26 swirls air in one direction creating a build-up on one side. The air director 7O assists in eliminating this.

An end of the conduit 28 distant the air inlet 22 is provided with an elongate shroud 72 for creating a substantially even air flow on the suction side of the fan 26.

The air grain clear.er 10 is conveniently mounted on a trailer 74 so that it may be transported readily from place to place.

The fan 26 is driven by motor or power take-off (not sho;n).

The operation of che air grain cleaner 10 will now be described.

A supply of grain is fed into the internal hopper 14. By turning the valve 18 grain mixture flows through inlet 20 into the air box 12 and initially impacts on grain deflecting plate 32. This causes the grain .mixture to travel in a parabolic path in a general direction toward the air inlet 22. Assuming that the fan 26 is being rotated an air stream flows through the conduit 28 toward the eir pressure equaliser 30. The air stream is then divided by and passes through the ducts 68 and then through the air inlet 22. It has been empirically discovered that the air pressure equaliser 28 acts to reduce the pressure gradient across the air inlet 22. The air stream entering the air box 12 from the inlet 22 is deflected upwardly toward vhe falling grain mixture by the air deflectors 34.

Grain which may land on the air deflector plates 34 Will, as: described above, slide down those plates and fall through a space between the plates in the air inlet 22 into the air box 12. This avoids the build-up of grain in the conduit 28.

when the air stream contacts the falling grain mixture, it pushes the grain and other components of the mixture different distances i a downstrea: direction due to their different weight and/or size so as to separate individual components of the mixture. Each component then falls ir. a different one of grain collection areas 62, 64 and 66. The position of the grain dividers 50 can be adjusted by manipulation of the handles 52 to vary the size of the respective grain collection areas 62, 54 and 66.

Now that an embodiment of the present invention has been described in detail, it will be apparent to those skilled i the relevant arts that numerous modifications and variations may be made without departing from the basic inventive concepts. For example, although the ducts 68 of air pressure equaliser 30 are shown as having a square cross-section, they can be made of any other cross-sectional shape, for example, circular, triangular, hexagonal, ecc. Also, individual ducts can be formed of a cross-sectional area which varies along tne length of the duct. Similarly, the cross-sectional area of difference ducts can also be made different.

Ail such modifications and variations are deemed to be within the scope of the present invention, the nature of which is to be determined from the foregoing description and the appended claims.

Claims

CLAIMS

1. An air grain cleaner when used for separating grain from a grain mixture comprising;
a chamber within which said grain can be separated from said grain mixture, said chamber including a first inlet disposed in an upper part of the chamber so that G grain mixture introduced through the first inlet can fall by auction of gravity into the chamber and, a second inlet for admitting an air stream into the chamber, said air stream directed toward sad grain mixture as it falls into the chamber;
a proteller-like fan in communication with said second Inlet for producing said air stream and including a plurality of fan blades extending radially from an axis of rotation of said fan;
an air stream equalising means for reducing the pressure gradient of said air stream across said second inlet, said air stream equalising means comprises a plurality cf ducts arranged in a matrix-like configuration for delivering said air streak from said fan to said second inlet;

area one or more air deflecting plates arranged in a stack located near but spaced from said second inlet, said plates being disposed in mutually parallel and inclined planes whereby, in use, said air stream blows any graln in said grain mixture 2 different distance in the downstream direction of the air stream from other components of said grain mixture to separate and thereby clean said grain from said other components cf the grain mixture, and any grain which lands on any one of said plates can slide down that plate by acticn of gravity to fall through the space between that plate and the second inlet into said chamber.

2. An air grain cleaner according to claim 1, further comprising opposite and substantially symmetrically profiled side walls, said opposite side walls having respective first portions which are uniformly spaced apart by a first distance and respective second portions which are uniformly spaced apart by a second distance being greater than said first distance, and one or more movable grain dividers for dividing a lower part of said chamber into a plurality of grain collection areas and disposed between said respective second portions, opposite sides of each grain divider extending laterally beyond adjacent first portions of said side walls.

3. An ar grain cleaner according to claim 2, wherein said air stream equalising means is located between said fan and said second inlet.

4. An air grain cleaner according to claim 3, wherein said air stream equalisinc means comprises 2 plurality of duals arranged in a matrix.

S. An air grain cleaner according to claim 4, wherein each of said ducts are of constant crcss-sectional area.

6. An air grain cleaner according to claim 5, wherein the cross-sectional area of each duct is substantially the saone.

7. An air grain cleaner according to claim 2 further comprising a conduit facilitating said communication between the propeller-like fan and said second inlet, said conduit including a dividing plate extending along a longitudinal central plane of at least a portion of the length of the conduit.

8. An air grain cleaner accorcing to claim 7, wherein an elongate shroud in which said propeller-like tan is housed, and having one end located adjacent said conduit.

said fan being disposed near said one end.

9. An air grain cleaner according to claim a wherein said air grain cleaner further comprises grain defl@@ting means for deflecting said grain mixture so as to fall in a direction toward said second inlet.

10. An air grain cleaner according to claim c, wherein said grain deflecting means comprises a plate disposed In an inclined plane and located adjacent said first inlet so that said grain mixture, after passing through said first inlet, falls onto and slides down said plate.

11. An air grain cleaner according to claim 10, wherein said ar deflecting plates are arranged for deflecting said air stream to flow in a direction substantially opposite to that in which said mixture falls.

12. An air grain cleaner according to claim 11, wherein said inclined plane is substantially parallel to tne planes containing said air deflecting plates.

13. An air grain cleaner substantially as herein described with reference to iiid as illustrated in the accompanying drawings.

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(54) Air grain cleaner

(57) An air grain cleaner 10 comprising a chamber in the form of an air box 12 within which grain can be separated from a grain mixture and thereby cleaned. The air grain cleaner has an internal grain hopper 14 which is provided with a manually operable valve 18 in an inlet 20 in a wall in an upper part of the air box 12 for introducing the grain mixture into the air box. A second inlet 22 is formed in a side wall 24 of the air box 12 for admitting an air stream into the air chamber. A fan 26 for producing the air stream communicates with the inlet 22 via a conduit 28. An air pressure equaliser 30 for reducing the pressure gradient of the air stream across the inlet 22 is located in the conduit 28 adjacent the inlet 22. A grain deflecting plate 32 is fixed within the air chamber 12 beneath inlet 20. Plate 32 is also inclined toward the air inlet 20. A plurality of air deflecting plates 34 arranged in a stack are inclined toward the grain inlet 20 to deflect the air stream to the grain. When the air stream contacts the falling grain mixture, it pushes the grain and other components of the grain mixture different distances in the downstream direction due to their different weight and/or size so as to separate the individual components of the grain mixture.

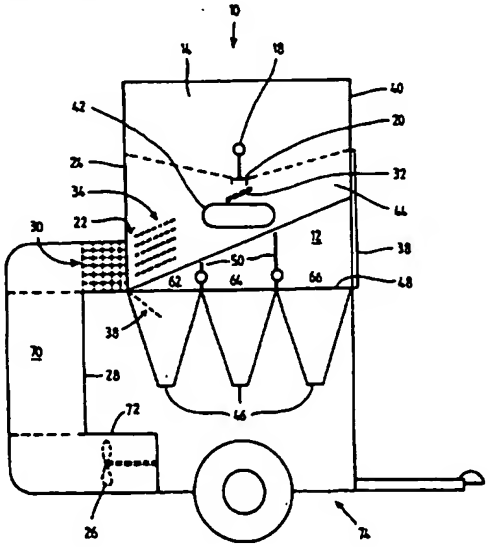

FIG.1

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.